

## DISPLAY CONTROL WITH ACTIVE HYPERTEXT DOCUMENTS

### Technical field

The invention relates to sequence control for computer programs, in 5 particular in the case of active hypertext documents, i.e. those involving execution of programs on the computer displaying the document.

### Prior art

In one application of data processing, a distinction is drawn between 10 the processing logic, i.e. the actual program, and the interaction with the user via a user interface, usually given this name, UI, or called a graphical user interface, (GUI). A known example is the GUI of the Windows operating systems, which is integrated into the executable program via interface calls. In this case, it is not possible to separate the processing 15 logic from the user interface calls. That is to say the processing logic and the structure of the interface are integrally combined with one another.

In quite a few application instances, however, it is desirable for the user interface and the processing logic to be separated. This starts with the creation of language-specific variants and ends with a different design 20 for the screen displays. In particular, this has resulted in the creation of highly complex development systems, such as Delphi from the company Inprise, which uses object-oriented programming to produce the sequence controller and uses an interactive formatting program to produce the user interface. Although this allows a change to be made much more quickly, 25 the programmer needs to understand the development environment fully so that no unwanted changes are made. Another approach to achieving this object is to use a standardized display program and to set up the screen display using a hypertext markup language, such as HTML. HTML allows the definition of input fields into which data can be entered by the 30 user, sent to a server via a network and processed there. Processing then takes place exclusively in the server, however, in particular using programs which are called on the basis of the common gateway interface, (CGI), and return a new HTML page as the result of the programmed sequence. However, since the HTML pages are produced by the CGI program, the

program and the user interface are again mixed. This solution has the additional disadvantage that it runs completely on the server.

Expansions of HTML have therefore been described using the keyword "active contents", said expansions permitting program execution on the system displaying the HTML page. These expansions are known by the (brand) names JAVASCRIPT, JAVA and ActiveX. In the case of JAVASCRIPT the instructions for the programs are embedded in the page, and, in the case of JAVA, are transmitted as a separate precompiled file (byte code). As before, there is a close link between program and representation by HTML, however. Since, in addition, the program parts are limited to one HTML page each, problems arise with regard to program organization if it is necessary to control complex transaction applications, as arise in the case of cash machines etc.

The object of the invention is therefore to specify a solution in which the user interface is decoupled from the execution logic and a standardized markup language such as HTML can still be used.

#### Summary of the invention

The solution comprises a series of steps which can each be used independently and are particularly advantageous in their entirety. Hence, the invention is described below on the basis of a simple process with the aid of the changes or supplements which can be applied to it in each case. The code examples used in this context are highly simplified to assist clarity, and possibly also perform functions for which integrated means are available.

#### Brief description of the figures

Figure 1 is a computer network diagram with associated software block diagram, illustrating a presently preferred embodiment of the invention;

Figure 2 is a detailed block diagram of the software architecture of a presently preferred embodiment, illustrating exemplary content, event handling mechanisms and messages that correspond to the code listings 1-4 ("Listings") appearing at the end of the specification.

### **Description of an embodiment of the invention**

The display control method and apparatus of the invention may be implemented to run in a browser environment. Figure 1 illustrates a

5 browser **20** running as an application program or operating system component on a computer **22**. The browser is configured in the conventional fashion to display web pages based on HTML code sent from a server **24** over a suitable computer network **26**, such as the Internet.

In accordance with the invention, the browser **20** is supplied with

10 HTML data corresponding to a controlling page **26** and to one or more displayed show pages **28**. As will be more fully explained below, the controlling page includes a frameset **30** that contains the HTML code corresponding to a displayed one of the show pages **28**. Where user interactivity is desired, the displayed show page **28** contains an event  
15 handling mechanism **32** that sends event messages back to the controlling page, which responds to those event messages by causing certain executable steps to be performed. Thus the controlling page **26** provides sequence controller functionality, illustrated diagrammatically at **34** while the show pages **28** provide user interface functionality, shown  
20 diagrammatically at **36**. The sequence controller functionality provides execution logic to the computer **22** while the user interface **36** provides the user display seen in browser **20**.

Figure 2 shows the presently preferred software system architecture in greater detail. The controlling page **26** contains computer code suitable

25 for utilization by the browser **20**. A presently preferred embodiment uses HTML code with embedded JavaScript. Other forms of executable code, including JAVA and ActiveX, may be used. Other markup languages, such as XML may likewise be used in place of HTML.

The controlling page **26**, when implemented using HTML, includes

30 an HTML framework **38**. The details of the controlling page are shown in listing 1, described more fully below. The HTML framework **38** encloses the executable code, such as JavaScript **40** and also a frameset for containing the page content **42**. In Figure 2 the frameset has been illustrated as a separate entity, frameset **44**, for illustration purposes.

Frameset **44** may include one or more frames containing show pages or other data. In Figure 2 frameset **44** is illustrated with two frames, a dummy show page **46** and a first displayed show page **48**. The first displayed show page is also identified in Figure 2, and in the code listings, 5 as "show1.htm."

The general layout for two exemplary show pages (show1.htm and show2.htm) are shown broken out at **50** and **52**. The show1.htm page **50** is currently loaded or referenced as show page **48**. The show1.htm page includes a user interaction input mechanism **54** and an event monitoring 10 mechanism **56**. The event monitoring mechanism sends event messages to the JavaScript **40**, causing it to perform certain execution logic.

When the user loads the controlling page **26** in browser **20**, the page content information within frameset **44** determines what the user will see in the user interface. The specific example illustrated in Figure 2 15 corresponds to the code listings below. As more fully discussed in reference to those code listings, the first loaded page, "dummy.htm" **46** is effectively an empty header containing no variable data. It is illustrated here simply to show that the frameset can contain page information that does not provide any active content. The second loaded page "show1.htm" 20 **48** generates the current user display. For purposes of this example, the user interaction input mechanism **54** of the show1.htm page is a message or prompt to the user "Please Enter Text." Below the prompt is an input field into which the user can type text that the user desires to input. Of course, this is merely one example. There are many different types of user 25 interaction input mechanisms available under current web technology. These include, dropdown list boxes, check boxes, radio buttons, active regions and the like.

The event monitoring mechanism **56** of the show1.htm page is an "onChange" JavaScript command in the present example. The "onChange" 30 command monitors the input field generated by the user interaction input mechanism. When the JavaScript detects a change event (such as, when the user types text into the field) the event handler mechanism sends an event message to the JavaScript **40**. In this example, the event message is a "putText" command that is sent back to the JavaScript **40** of the

controlling page 26. It bears noting that the "onChange" event command and the "putText" event message are merely examples, suitable for capturing text input from the user. Any event detection mechanisms and event messages available in the executable scripting language may be used to effect the desired results.

5 used to effect the desired results.

Upon receipt of the "putText" message, the JavaScript 40 performs the sequence of execution logic coded for that input message. In this example, the script first writes the user's input into a global variable space **60** as the global variable "theText." Then the script performs a display page replacement. Specifically, it loads show2.htm **52** in the location within frameset **44** previously occupied by the show1.htm page **50**. By substituting a new show page for the originally displayed one, the user is presented with a different display that is dictated by the contents of show2.htm page **52**. This new content could include the same user interaction mechanism employed in the show1.htm page, or another user interaction input mechanism. The JavaScript event may be the same "onChange" event, with the same "putText" event message as used before. Alternatively, a different and/or event message can be used.

20 While the show pages employed thus far have permitted user interaction, it is also possible to load pages into frameset 44 that do not allow user interaction or display active content. The choice of what to display and what interaction to permit will depend on the purpose of the web site being constructed using this technology. With the foregoing overview in mind, reference will now be made to the code listings 1-4 appearing at the end of this specification. Code listing 1 shows the code for the controlling page 26 featured in Figures 1 and 2. Listings 2 and 3 show exemplary code for the first display screen (show1.htm) and second display screen (show2.htm). Listing 4 shows exemplary code for a display screen without variable contents.

30 Listings 1 to 3 show codes formulated in the language HTML, which may be familiar. The numbers placed before the lines serve merely for the purpose of better reference and are not part of the coded instructions. The examples relate to the display program Netscape Communicator 4.7, called "browser" below.

Listing 1 shows the code for the controlling page. Lines 1 and 17 are part of the framework prescribed in HTML. Lines 2 to 12 contain JAVASCRIPT commands defining three functions, in particular, which are described more precisely further below in the context of their use.

5 Lines 13 to 16 define the content of the page as a frameset, in this case with horizontal subdivision into two frames, the first of which has a height of 10 pixels and the second of which fills up the remainder. The definitions of the two frames can be found under "dummy.htm" and "show1.htm" and are shown in Listing 4 and Listing 2. Provided that the  
10 browser so permits, preferably only one frame within the frameset is used, with the result that the "dummy.htm" frame, which is effectively empty and contains no kind of variable data, can be dispensed with.

Listing 2 shows the HTML text "show1.htm" loaded into the frame in which interaction with the user takes place. In this simple example, this  
15 merely comprises the prompt "Please Enter Text" in the second line and an input field in line 4, the "onChange" parameter in line 5 defining JAVASCRIPT event handling for said input field. This stipulates that the "putText" function defined in line 4 of Listing 1 be called using the content of the "this.value" input field when the field content is changed. Depending  
20 on the browser, this function occurs when the TAB key or the ENTER key is used to leave the field, possibly depending on the further content of the page.

This "putText" function first stores the text submitted as parameter "x" in the global variable "theText" in line 5 of Listing 1. After a check in line  
25 6 to determine whether the text is not empty, the frame's displayed screen, which has up to now been defined by "show1.htm", is then replaced by "show2.htm" in line 7, in accordance with the invention. The result of this is thus that there is no sequence controller in the page which is defined by "show1.htm" and represents the user interface, but instead sequence  
30 control is effected by a function which is contained in another page, in this case in the page having the frameset, which again produces no kind of variable output visible to the user. In a realistic application, the functional body of the "putText" function, which in this case has been reduced to its essence for the sake of clarity, contains a complex sequence controller

exhausting the possibilities of a programming language such as JAVASCRIPT.

Execution of line 5 in Listing 1 loads the HTML text shown in Listing 3 into the frame in which "show1.htm" has been active up to now. This 5 screen comprises a prompt "Your Input:" in line 4, a field "was" used for the output in line 5 and a button "Again" in line 6. The "onLoad" statement in line 2 calls the "getText" function, again from the superordinate frameset in Listing 1, in that case lines 8-9, and stores the result in the output field "was" in line 5 Listing 3. Once this HTML page has loaded, the previously 10 entered text thus appears in the input field.

Pressing the "Again" button calls the "again" function from the frameset in Listing 1 lines 10-11, which in turn loads the first page "show1.htm" instead of the one displayed. In a realistic application, control will take place on the basis of complex program logic in this case too.

15 The result of this is that the sequence controller, which in this case minimally implements merely the change between two screen based on "show1.htm" and "show2.htm", is stored exclusively in the HTML text shown in Listing 1.

Instead of using frames, as illustrated up to now, it is also possible 20 to open a new window, e.g. using the script command "openWindow". The Internet Explorer browser supports a "fullscreen" parameter for this, which makes the new window fill up the screen completely and thus cover the screen containing the controller, so that it is no longer visible to the user.

The application of the invention is particularly useful if local 25 peripherals such as a magnetic card reader, a mouse or a keyboard are to be included, in the latter case also in special versions. In this case, handling is performed exclusively in the page containing the sequence controller.

Particularly if peripheral events such as keys being pressed or a 30 magnetic card reader being activated by the insertion of a card need to be taken into account, the sequence controller can change the displays. This is possible using the "document object model" (DOM), which has already been used in the example. The page change effected in lines 7 and 11 by changing the "location" property of the "show" object as a subobject of

"top" is one capability of the DOM. In the same way, the sequence controller can change the value of the field in line 5 of Listing 3 by assignment to "document.show.form1.was.value". In this context, however, it should be taken into account that this is possible only when "show2.htm" 5 is loaded completely, for which reason the solution in line 2 has been preferred in the present example for the sake of clarity. However, it is evident that it is also possible to dispense completely with active contents on the page representing the user interface.

The use of field names is compliant with a conventional interface. 10 However, the pages producing the user interface preferably contain defined functions which change the fields and consequently hide the field names. This is more compliant with an object-oriented interface. In both cases, before calling the functions or reading or writing fields, the sequence controller will use the "typeof" operator to ensure that the object 15 to be addressed is in fact present. This measure is supported if, during sequence control, the page uses the "onLoad" attribute of "<body>" to signal that interfaces are activated, and which interfaces are activated, and possibly also supplies references to the interface functions or data fields. This technique of recording functions and data fields is generally also 20 known by the term "callback" and can be advantageously applied within the scope of the invention.

It should now be apparent that the data structures and corresponding executable code components are well-suited for delivery to a computer over a suitable computer network such as the Internet. The 25 controlling page and associated show pages, structured in accordance with the foregoing, may be sent as packets of information over the computer network (e.g., computer network 26 of Fig. 1). These packets of information represent electronically embodied articles of manufacture when embedded in a suitable carrier wave to effect the transfer or propagation 30 from server 24 to computer 22. It will, of course, be appreciated that these packets of information can be sent over any communications medium, including wire, broadband cable, fiberoptic cable, wireless broadcast, and the like.

**CODE LISTING 1**

```
1.  <html><head><title>MAIN</title>
2.  <script language="javascript">
3.  var theText = "Initial Text" ;
5.  function putText(x) {
6.      theText = x ;
7.      if (theText != "") {
8.          top.show.location="show2.htm"; }
9.      function getText() {
10.         return theText; }
11.      - top.show.location="show1.htm"; }
12.  </script></head>
13.  <frameset rows="10,*">
15. 14.      <frame name=dummy src="dummy.htm"></frame>
15. 15.      <frame name=show src="show1.htm"></frame>
16. 16.  </frameset>
17. 17.  </html>
```

**CODE LISTING 2**

```
1.  <html><head> <title>SHOW1</title> </head>
2.  <body>Please Enter Text:<br>
3.  <form>
4.  <INPUT type="text" value="" 
25. 5.      onChange="top.putText(this.value);"
6.  </form>
7.  </body></html>
```

**CODE LISTING 3**

```
30 1.  <html><head> <title>SHOW2</title> </head>
2.  <body onLoad="document.form1.was.value=top.getText();"
3.  <form name="form1">
4.  Your Input:
5.  <input type="Text" name="was">
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```
6.   <input type="button" name="Again" value="Again"
7.       onClick="top.again()"
8.   </form>
8.   </body></html>
```

5

**CODE LISTING 4**

```
1.   <html><head> <title>DUMMY</title> </head>
2.   <body> DUMMY </body></html>
```

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